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Three-Dimensional High-Resolution Seismic Profiling on the New Jersey Outer Continental Shelf

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Long-Term Objectives

The morphology, shallow stratigraphy and resulting acoustic properties of the continental shelf and upper slope predominantly reflect local sedimentologic events, often episodic events related both to the introduction and redistribution of these sediments. This project has been concerned mainly with the three-dimensional variation of these parameters as documented by high-resolution seismic profiling, and their correlation with actual sedimentological, geotechnical and morphologic properties of the seafloor and its sediments.

Project Objectives

Previous work using the Huntec Deep-Towed Seismic (DTS) system off New Jersey (1987) identified a thick sequence of late Pleistocene sediments on the outer continental shelf. It was suggested (Milliman et al., 1990) that these sediments were deposited by several major melt events during the late Wisconsin glaciation. The physical nature of the sediments, their stratigraphic relation with acoustic stratigraphy and the fine-scale variations of both reflectors and topographic character, however, can be defined only through sediment coring and closely spaced high-resolution profiling. The purpose of this project was to obtain a series of vibrocores to determine the stratigraphic and sedimentologic character of the sediments and to obtain digital data that would allow us to gain a three-dimensional understanding of the shallow structure on the sedimentary sequences in this area.

While this project specifically relates to conditions and late Quaternary history on the outer shelf and upper slope off New Jersey and New York, similar histories (and resulting sediments) appear to have occurred elsewhere in the higher latitudes, such as off eastern Greenland and western Spitsbergen.

Accomplishments

Huntec seismic profiles taken in 1987 and 1988 show two dominant sediment wedges on the outer shelf and upper slope off New Jersey . The wedge along the 60-m contour interval coincides with the Fortune Shore that apparently was deposited 11-12 thousand years ago, as sea level was transgressing. Presumably this represents the last major seaward discharge of Hudson River sediment.

In contrast, the large sediment wedge on the outer shelf may have been deposited during sea level regression, about 18 thousand years ago, perhaps as an outwash plain. The transition from acoustically laminated sediments in the north to non-laminated sediments in the south may indicate longshore transport of eroded sands from the outwash plain. 3-D seismic studies obtained by UT/ Austin and WHOI in 1989 suggest the presence of shallow N-S channels eminating from the laminated deposit in the north, which supports the possibility of southward transport (Austin et al., 1990).

Vibrocores and short piston cores obtained 1989 show the varying sand/mud contents with location and core depth. At least three cores penetrated to reflector R, assumed to represent the erosional horizon over which late Quaternary sediments accumulated. At present only one C-14 date has been obtained from these cores - that of a mollusk shell from 2m in vibro-core #3. Whereas we would have predicted an age of about 18 thousand years B.P. for this sample, the date obtained (from Beta Analytic, Miami) is 4490 +/- 110 years B.P. Clearly, either our hypothesis about the age of these deposits is wrong or the mollusk shell date is extraneous. Since we cannot envision a large influx of sediment during the mid-Holocene, we assume that the date does not correctly indicate the age of this deposit.

Finally, it should be noted that a search of USGS files has uncovered an extensive medium-grid coverage of Huntec DTS data obtained in the late 1970's by the Mineral Management Service (MMS) in preparation for offshore lease sales. While these data need to be analyzed carefully, preliminary inspection of the profiles indicates that the outer shelf sediment wedge ends abruptly on the upper slope in water depths of about 200 m. Presumably any sediment deposited in the wedge seaward of this depth was removed and transported downslope; it is not unlikely that this "absent" sediment may have served as a major source of terrigenous sediment deposited on the lower slope and rise during the late Quaternary.

Publications

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